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REMARKS/ARGUMENTS

Reconsideration of this application is respectfully requested.

The Examiner's attention is drawn to the IDS filed May 21, 2003 and to the reference newly cited therein (US Patent 5,122,487 - Hiyakawa et al).

Previously non-elected claims 7-12, now withdrawn from consideration, have been cancelled without prejudice or disclaimer.

The rejection of remaining claims 1-6 under 35 U.S.C. §112, second paragraph is respectfully traversed.

In the field of chemistry and physics, the suffix "-series" is commonly used to describe a related group of structures (e.g., related by linearly varying successive differences in form or configuration such as a radioactive decay series, a paraffin alkane series, etc.). In this sense, in the specification and in the claims as originally filed, the term "zirconia-series" was intended to signify the fact that the claimed electrolytic sheet belongs to a "zirconia-series" type of material. Similarly, the claimed insulating sheet is formed from an alumina-series type of material. Furthermore, it is clear from the original claims that the layered structure needs to include at least one electrolytic sheet and at least one insulating sheet.

Amendments have been made to claims 1-6 in an attempt to clarify this situation and avoid any possible indefiniteness.

Accordingly, all outstanding formal issues are now believed to have been resolved in the applicant's favor.

The rejection of claims 1, 2, 4-6 under 35 U.S.C. §103 based on Mase et al '693 or Mase et al '456 in view of Radford et al '400 or Kobayashi et al '835 is respectfully traversed.

The present invention helps assure sufficient bonding strength at the bonding boundary between a zirconia-series solid electrolytic sheet and an alumina-series insulating sheet for a multilayered gas sensing element. None of the cited references Mase et al '693, Mase '456, Radford et al '400 and Kobayashi et al '835 even disclose this object.

The multilayered gas sensing element of this invention includes a crystal phase containing SiO₂ at least partly in the bonding boundary between the zirconia-series solid electrolytic sheet and the alumina-series insulating sheet. During sintering of the multilayered gas sensing element, the SiO₂ containing crystal phase intervening between the zirconia-series solid electrolytic sheet and the alumina-series insulating sheet causes self-reaction or interacts with other components. The crystal phase is liquefied. Material transfer occurs between the zirconia-series solid electrolytic sheet and the

alumina-series insulating sheet via the liquefied phase during the sintering operation, as a result.

None of the cited references teach or suggest added SiO₂ causing material transfer in the liquefied state during the sintering to enhance bonding strength between a zirconia-series solid electrolytic sheet and an alumina-series insulating sheet.

Furthermore, while SiO₂ contributes to bonding strength, the crystal phase containing SiO₂ does not worsen ^{the} oxygen ion conductivity of the zirconia-series solid electrolytic sheet. No blacking or migration is caused even when the crystal phase is subjected to heat generated from a heater embedded in the multilayered gas sensing element. Accordingly, the multilayered gas sensing element with improved structural characteristics still functions properly.

The Examiner contends that Radford discloses adding 0.5 to 2 mol% of silica to a zirconia solid electrolyte to lower the sintering temperature of the zirconia solid electrolyte so that the solid electrolyte and the electrode can be sintered at the same temperature.

However, Radford fails to disclose the bonding boundary between the zirconia solid electrolytic sheet and the alumina insulating sheet.

Radford also fails to disclose that a crystal phase containing SiO₂ is included at least partly in the bonding boundary between the zirconia solid electrolytic sheet and the alumina insulating sheet.

In this respect, the Examiner states that it would have been obvious to add silica to the zirconia sheets of either Mase reference in view of Radford merely because Radford discloses silica to be a sintering aid that would lower the sintering temperature of zirconia.

However, neither Mase reference is directed towards any reduction in sintering temperature. Thus there is no motivation for one of ordinary skill in the art to combine Radford with either Mase reference.

The Examiner's proposed combination of Radford with either Mase reference can only be based on hindsight. There is no suggestion in any reference that would explain why one practicing the teaching of either Mase reference would incorporate silica as disclosed in Radford.

On the other hand, the Examiner states Kobayashi discloses adding silica to a zirconia solid electrolyte. The examiner thus concludes that it would also have been obvious for one practicing either Mase reference teaching to incorporate silica in its zirconia sheets in view of Kobayashi, because that would give the zirconia an

advantageous coefficient of thermal expansion as well as better low temperature operating characteristics and better life characteristics.

However, this alleged reason for combining Kobayashi with either Mase reference is also based solely on hindsight. There is no apparent reason why one practicing either Mase reference teaching would incorporate the silica disclosed in Kobayashi.

The rejection of claim 3 under 35 U.S.C. §103 based on either Mase et al in view of Radford et al or Kobayashi et al and Ishiguro et al is also respectfully traversed.

It is difficult to even contemplate exactly how the Examiner contends different portions of these five different references are supposed to be found obvious to combine by one having only ordinary skill in the art. In any event, major deficiencies with respect to the first four of these references have already been noted above with respect to parent claim 1 and therefore it is not believed necessary at this time to discuss the further deficiencies of the fifth reference.

The rejection of claim 5 under 35 U.S.C. §103 as allegedly being made "obvious" over either Mase et al in view of Radford et al or Kobayashi et al and JP '409 is also respectfully traversed -- for reasons similar to those just discussed with respect to this further different five-way combination of references cited in connection with claim 3.

The rejection of claim 6 under 35 U.S.C. §103 as allegedly being made "obvious" based on either Mase et al reference in view of Radford et al or Kobayashi et al and JP '571 is similarly traversed -- for reasons that are also similar to those already explained above for claims 3 and 5 where the Examiner has alleged yet a different five way combination of references to somehow be made "obvious" to one having only ordinary skill in the art.

As the Examiner is well aware, there must be suggestion (explicit or at least necessarily implicit) in the teaching of at least one of the references being combined that would have suggested to one of ordinary skill in the art to make the modification being now alleged by the Examiner as "obvious". It is respectfully submitted that the Examiner has not satisfied the obligation and duty to point out exactly where such suggestion resides in any of these cited references for the various complicated combinations of numerous references now alleged to be made "obvious". It is respectfully submitted that the Examiner's allegations are substantially based on hindsight in view of the applicant's own invention.

The Examiner's attention is also drawn to new dependent claim 13 (for which there is support at least at pages 12 and 13 of the specification).

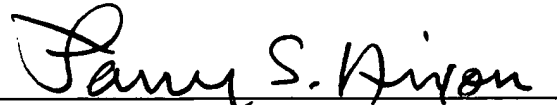
SUGIYAMA
Appl. No. 09/873,287
July 14, 2003

Accordingly, this entire application is now believed to be in allowable condition
and a formal Notice to that effect is respectfully solicited.

Respectfully submitted,

NIXON & VANDERHYE P.C.

By:

A handwritten signature in cursive script, appearing to read "Larry S. Nixon", is written over a horizontal line.

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